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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/534,795	05/12/2005	Mamoru Tsuruya	44471/314326	1651

23370 7590 03/01/2007
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EXAMINER

HANSEN, STUART ALAN

ART UNIT	PAPER NUMBER
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2809

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/01/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/534,795

Applicant(s)

TSURUYA, MAMORU

Examiner

Stuart Hansen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 5/12/2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 5/12/2005.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action is written in response to the Application 10/534,795 filed May 12, 2005. It is also acknowledged that this Application is under National Stage under PCT/JP04/08323 filed June 14, 2004, and is eligible for Foreign Priority under JP2003-291594 filed August 11, 2003.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 1-3 & 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over LaFleur et al. (US 6,600,402 B1, filed 10/20/1998, dated 7/29/2003), and further in view of Roberts (US 4,613,841, filed 4/15/1985, dated 9/23/1986).

With respect to claim 1, LaFleur et al. teach: A switching power supply (Fig 3) comprising: a first series circuit, connected to both terminals of a direct current power supply (Fig 3 [V_{IN}]), in which a primary winding (Fig 3 [23]) of a transformer (Fig 3 [24]), and a first switch (Fig 3 [28]) are connected in series; a second series circuit (Fig 3 [30]), connected to one of both terminals of the first switch (Fig 3 [28]) and both terminals of the primary winding (Fig 3 [23]), in which a second switch and a capacitor are connected in series (Fig 3 [30]); and a smoothing circuit (Fig 3 [32, 33]) smoothing a

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voltage developed across a secondary winding (Fig 3 [26]) of the transformer (Fig 3 [24]).

LaFleur et al. lack anticipation however by not teaching: a reactor in the first series circuit, the second series circuit being connected to the reactor in series with the primary winding, a control circuit alternately turning on and turning off the first and second switches, wherein the transformer includes a main core, formed with a magnetic circuit, on which the primary and secondary windings are wound with a given gap, and a plurality of auxiliary cores disposed in the given gap with a given distance in a circumferential direction of the primary winding, and wherein the reactor is formed of a leakage inductance of the transformer.

The transformer (Fig 3 [24]) with primary (Fig 3 [23]) and secondary (Fig 3 [26]) windings of LaFleur et al. is depicted as an ideal transformer. It is well known, however, that all transformers are not ideal and will inherently exhibit leakage inductance which can be modeled as an extra reactance in series with the primary winding. Therefore there is inherently a reactance formed of a leakage inductance of the transformer, that it is in series with the first series circuit, and that it is also in series with the second series circuit. It would have been obvious to one of ordinary skill in the art at the time of the invention that a control circuit exists to alternately turn on and off the first and second switches, as is alluded to in the discussion of zero-voltage switching (column 1 lines 53-65). The control circuit is necessary because without it, the switching power converter (Fig 3) would not perform its function if the switches were constantly open or closed and not operated repeatedly in succession.

Roberts teaches: wherein the transformer includes a main core (Fig 9 [120]), formed with a magnetic circuit, on which the primary (Fig 9 [10]) and secondary (Fig 9 [20]) windings are wound with a given gap (Fig 9 [105]), and a plurality of auxiliary cores (Fig 9 [153]) disposed in the given gap with a given distance in a circumferential direction of the primary winding.

Both Roberts and LaFleur et al. use transformers for voltage conversion, therefore it would have been obvious to replace the transformer of the direct current voltage converter of LaFleur et al. for the transformer of Roberts for the purpose creating a controllable, more ideal leakage inductance value to better accommodate zero-voltage switching.

Regarding claim 2, the combined device with the transformer of Roberts further teaches: a cylindrical inner bobbin (Fig 9 [152]) on which the primary winding (Fig 9 [10]) is wound; and an outer bobbin (Fig 9 [150, 151]) having a diameter larger than that of the inner bobbin (Fig 9 [152]) on which the secondary winding (Fig 9 [20]) is wound, and having a plurality of slits (Fig 9 [105]), formed in a given distance along the circumferential direction, which accommodate the plurality of auxiliary cores (Fig 9 [153]), respectively, and wherein the inner bobbin (Fig 9 [152]) is mounted to the main core (Fig 9 [120]) under a condition where the inner bobbin (Fig 9 [152]) is inserted to the outer bobbin (Fig 9 [150, 151]).

In regard to claim 3, the combined device with the transformer of Roberts further teaches: a cylindrical inner bobbin (Fig 9 [152]) on which the primary winding (Fig 9 [10]) is wound; and an outer bobbin (Fig 9 [150, 151]) having a diameter larger than that

of the inner bobbin on which the secondary winding (Fig 9 [20]) is wound, which is made of insulating magnetic material (column 7 lines 41-44), and wherein the inner bobbin (Fig 9 [152]) is mounted to the main core (Fig 9 [120]) under a condition where the inner bobbin (Fig 9 [152]) is inserted to the outer bobbin (Fig 9 [150, 151]).

Regarding claim 7, LaFleur et al. lack anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the second switch when a current of the second switch increases, because the core resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully discharged, and that would be an opportune point to switch, allow zero-voltage switching.

Regarding claim 8, LaFleur et al. lack anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of

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the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the second switch when a current of the second switch increases, because the core resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully discharged, and that would be an opportune point to switch, allow zero-voltage switching.

Regarding claim 9, LaFleur et al. lack anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the second switch when a current of the second switch increases, because the core resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully

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discharged, and that would be an opportune point to switch, allow zero-voltage switching.

Claim 4-6 & 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over LaFleur et al. (US 6,600,402 B1, filed 10/20/1998, dated 7/29/2003), further in view of Harris et al. (US Re. 31,840, filed 7/7/1982, dated 2/26/1985), and further in view of Roberts (US 4,613,841, filed 4/15/1985, dated 9/23/1986).

With respect to claim 4, LaFleur et al. teach: A switching power supply (Fig 3) comprising: a first series circuit, connected to both terminals of a direct current power supply (Fig 3 V_{IN}), in which a primary winding (Fig 3 [23]) of a transformer (Fig 3 [24]), and a first switch (Fig 3 [28]) are connected in series; a second series circuit (Fig 3 [30]), connected to one of both terminals of the first switch (Fig 3 [28]) and both terminals of the primary winding (Fig 3 [23]), in which a second switch and a capacitor are connected in series (Fig 3 [30]); and a smoothing circuit smoothing a voltage developed across a secondary winding (Fig 3 [26]) of the transformer (Fig 3 [24]).

LaFleur et al. lack anticipation however by not teaching: a reactor in the first series circuit, the second series circuit being connected to the reactor in series with the primary winding, a control circuit alternately turning on and turning off the first and second switches, a feedback winding, located on a secondary side of the transformer, which allows energy stored in the reactor when the first switch is turned on to be circulated to the secondary side when the first switch is turned off, wherein the transformer, formed with a magnetic circuit, including: a main core that has a central leg on which the primary winding of the transformer and the feedback winding are wound

with a given gap and a side core on which the secondary winding of the transformer is wound; and a plurality of auxiliary cores disposed in the given gap with a given distance in a circumferential direction of the primary winding, and wherein the reactor is formed of a leakage inductance of the transformer.

The transformer (Fig 3 [24]) with primary (Fig 3 [23]) and secondary (Fig 3 [26]) windings of LaFleur et al. is depicted as an ideal transformer. It is well known, however, that all transformers are not ideal and will inherently exhibit leakage inductance which can be modeled as an extra reactance in series with the primary winding. Therefore there is inherently a reactance formed of a leakage inductance of the transformer, that it is in series with the first series circuit, and that it is also in series with the second series circuit. It would have been obvious to one of ordinary skill in the art at the time of the invention that a control circuit exists to alternately turn on and off the first and second switches, as is alluded to in the discussion of zero-voltage switching (column 1 lines 53-65). The control circuit is necessary because without it, the switching power converter (Fig 3) would not perform its function if the switches were constantly open or closed and not operated repeatedly in succession.

Harris et al. however do teach: a feedback winding (Fig 2 [70T]) located on a secondary side of the transformer (Fig 2), which allows energy stored in the reactor when the first switch (Fig 1 [13]) is turned on to be circulated to the secondary side when the first switch (Fig 1[13]) is turned off, wherein the transformer, formed with a magnetic circuit, including: a main core (Fig 2 [15]) that has a central leg (Fig 2 [left pole]) on which the primary winding (Fig 2 [16]) of the transformer (Fig 2 [14]) and the

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feedback winding (Fig 2 [70T]) are wound, and a side core (Fig 2 [Stackpole 24B]) on which the secondary winding (Fig 2 [145T]) of the transformer (Fig 2 [14]) is wound.

Harris et al. and LaFleur et al. both teach voltage conversion systems, therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the transformer of Harris et al. with the conversion circuit of LaFleur et al. for the purpose of introducing a feedback winding coupled to the primary side, connected to the secondary side to allow excess magnetization energy to flow to the secondary side, increasing efficiency and conserving energy.

Harris et al. though do lack anticipation by not teaching: the primary winding of the transformer and the feedback winding are wound with a given gap; and a plurality of auxiliary cores disposed in the given gap with a given distance in a circumferential direction of the primary winding.

Roberts however does teach: the primary winding (Fig 9 [10]) of the transformer (Fig 9) and the feedback winding (Fig 9 [20]) are wound with a given gap (Fig 9 [105]); and a plurality of auxiliary cores (Fig 9 [153]) disposed in the given gap (Fig 9 [105]) with a given distance in a circumferential direction of the primary winding.

Roberts and the combined device of Harris et al. and LaFleur et al. both teach voltage conversion circuitry and transformers, so it therefore would have been obvious to one of ordinary skill in the art at the time of the invention to combine the transformer of Roberts with the main core of the transformer of the combined device of LaFleur et al. and Harris et al., substituting the secondary winding with a feedback winding. This

combination would have allowed a controllable, more ideal leakage inductance value to accommodate zero-voltage switching.

Regarding claim 5, the combined device with the main core of Harris et al. with the transformer of Roberts further teaches: a cylindrical inner bobbin (Fig 9 [152]) on which the primary winding (Fig 9 [10]) is wound; and an outer bobbin (Fig 9 [150, 151]) having a diameter larger than that of the inner bobbin on which the feedback winding (Fig 9 [20]) is wound, and having a plurality of slits (Fig 9 [105]), formed in a given distance along the circumferential direction, which accommodate the plurality of auxiliary cores (Fig 9 [153]), respectively, and wherein the inner bobbin (Fig 9 [152]) is mounted to the central leg of the main core (Fig 9 [120]) under a condition where the inner bobbin (Fig 9 [152]) is inserted to the outer bobbin (Fig 9 [150, 151]).

In regard to claim 6, the combined device with the main core Harris et al. with the transformer of Roberts further teaches: a cylindrical inner bobbin (Fig 9 [152]) on which the primary winding (Fig 9 [10]) is wound; and an outer bobbin (Fig 9 [150, 151]) having a diameter larger than that of the inner bobbin on which the feedback winding (Fig 9 [20]) is wound, which is made of insulating magnetic material (column 7 lines 41–44), and wherein the inner bobbin (Fig 9 [152]) is mounted to the main leg of the main core (Fig 9 [120]) under a condition where the inner bobbin (Fig 9 [152]) is inserted to the outer bobbin (Fig 9 [150, 151]).

Regarding claim 10, LaFleur et al. lack anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the second switch when a current of the second switch increases, because the core resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully discharged, and that would be an opportune point to switch, allow zero-voltage switching.

Regarding claim 11, LaFleur et al. lack anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the second switch when a current of the second switch increases, because the core

resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully discharged, and that would be an opportune point to switch, allow zero-voltage switching.

Regarding claim 12, LaFleur et al. lack anticipation by not teaching: the control circuit turns off the second switch when a current of the second switch increases.

LaFleur et al. however do inherently teach: a saturable reactor connected to both terminals of the primary winding of the transformer to utilize a saturable characteristic of the core of the transformer (column 1 lines 49-65). It is discussed that using the saturable reactor, along with the core resetting circuit Fig 3 [30], which is parallel to the primary winding and would make the saturable reactor parallel to the primary winding as well, can be used to allow zero-voltage switching. It would have also been obvious to one of ordinary skill in the art at the time of the invention, the control circuit turns off the second switch when a current of the second switch increases, because the core resetting circuit (Fig 3 [30]) helps to discharge the transformer fully, and when the current begins to rise again would be an indication that the transformer has fully discharged, and that would be an opportune point to switch, allow zero-voltage switching.

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stuart Hansen whose telephone number is 571-270-

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1611. The examiner can normally be reached on 7:30- 5 M-Th, Alt. Frid 7:30-4 Est Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Loke can be reached on 571-270-2100. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Stuart Hansen
February 27, 2007



STEVEN LOKE
SUPERVISORY PATENT EXAMINER

